MERIDIONAL OVERTURNING VARIABILITY EXPERIMENT

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Project Summary

A present gap in the sustained ocean climate observing system are techniques and programs for monitoring the circulation and mass/heat/freshwater transports of major current systems. Depending on the intensity, width, and depth extension of the current to be observed, different approaches and technologies exist now which allow implementation and maintenance of such "transport reference sites". For broad-scale and deep-reaching circulations, a recently demonstrated method consists of fixed-point installations with moored and bottom-mounted instruments to obtain horizontally and vertically integrated measurements throughout the watercolumn. The new MOVE project intends to maintain the developed elements of the first such system by taking over partial operation of a moored transport array in the Atlantic.

In the year 2000 the German CLIVAR programme initiated the circulation monitoring array (MOVE) in the subtropical west Atlantic along 16N, in order to observe the transport fluctuations in the North Atlantic Deep Water layer. Since then, three "geostrophic end-point moorings" plus one traditional current meter mooring on the slope have been used to cover the section between the Lesser Antilles (Guadeloupe) and the Midatlantic Ridge. The goal is to determine the transport fluctuations through this section, using dynamic height and bottom pressure differences between the mooring for estimates of the geostrophic transport.

To date, the array has delivered over 90% data return, and due to the built-in redundancy, transports are available for the full 6-year deployment period from German funding. The goal of the NOAA project is the continuation of the MOVE transport array in a reduced form (2 endpoint moorings plus current meter mooring on the slope), while complementing it on the eastern side of the Atlantic with a German-funded and operated mooring (near the Cape Verde islands). Numerical simulations by T.Kanzow (Ph.D. dissertation) have shown high skill of such an ocean-wide system for capturing the total meridional NADW transport across the latitude line, and IfM-Geomar/Kiel has committed to cooperate by providing the eastern end-point mooring.

With the new MOVE project, SIO will operate the two geostrophic endpoint moorings between the western boundary and the Midatlantic Ridge, plus the small current meter mooring on the slope. In the first years, the acquisitions for complete configuration of the moorings will take place, and the array will gradually be built up to its full implementation. In later years, routine operation will be achieved, and routine delivery of indicators about the state of the thermohaline overturning circulation at this latitude will be enabled.

FY 2006 Activities

A German cruise on RV 'Merian' was used in December 2006 to re-deploy the MOVE moorings. An arrangement had been reached with IfM-Geomar (Kiel) and the German funding agency whereby two days of ship time could be saved on the December cruise by doing acoustic data readout from two inverted echosounders/pressure sensors (PIES) on the later spring'07

NOAA NTAS cruise. These two days of ship time were then available for the mooring deployments for the current MOVE project.

November 2006

Due to the limited funding in year 1, not all the required mooring hardware and sensors could be purchased from MOVE. Therefore, the two new microcat moorings that were deployed in December on the German cruise still use some German equipment and wire purchased with leftover German funds, and the current meter mooring on the continental slope carries entirely German equipment (current meter, flotation, acoustic release). Also the PIES which were to remain in the water were mainly German ones. Additional flotation and microcats were borrowed from other SIO projects of the P.I..

On the other hand, we used the MOVE startup funding to purchase 20 microcats, to pay salaries for the mooring and cruise preparations, to pay container shipment and travel of three SIO participants in the German cruise. We also constructed new top float assemblies for the moorings, which carry new ARGOS beacons purchased (these activate after surfacing) plus recovery aids (FM radio and flasher).

The joint SIO/IfM-Geomar cruise in December 2006 successfully recovered the previous MOVE moorings (plus a tomography system) and redeployed 2 microcat transport moorings, and 1 current meter mooring on the continental slope. However, not all equipment is MOVE or even SIO owned.

Problems were found with the existing PIES in the array, four of which were meant to be only visited and have data read out acoustically. All of them were found inoperational, i.e. they did not transmit data and were not acquiring data anymore. Since the release mechanism is powered separately, they could be recovered and diagnosed. A faulty battery configuration by the manufacturer had caused failure of the units one year prior to this cruise.

Because of this problem with the PIES, the April 07 NTAS cruise was used to redeploy PIES systems with corrected battery assemblies. Two new PIES purchased with NOAA funds were

prepared and shipped to the “Ron Brown” NOAA cruise, and another three PIES were sent from Germany to complement the MOVE bottom pressure array for GRACE validation measurements. At the time of writing, the cruise is proceeding, and has already successfully deployed the two NOAA owned PIES next to the microcat moorings (deployed in December), and two additional German PIES. The PIES are expected to operate for 4years, and data will be retrieved each year on the NTAS cruises, when the moorings are serviced.

As such, we now have a rudimentary MOVE array operating again, with the two basic geostrophic endpoint moorings covering the North Atlantic Deep Water using microcats, plus PIES bottom pressure measurements, and a slope mooring. Next year, all the loaned equipment has to be returned and both sensors and mooring hardware have to be from NOAA project funding. In the long run, the mooring coverage should be extended to the surface again, and dual PIES should be deployed at each mooring, to allow rotating the 4-year deployments with 2-year overlap – this would significantly reduce the long-term sensor drift in the bottom pressures and allow recognition of interannual variability.